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Indiana Coke & Gas Co.	Terre Haute, Ind.
Battle Creek Gas Co.	Battle Creek, Mich.*
Consumers Power Co.	Zilwaukee, Mich.*
Winnipeg Gas & Electric Co.	Winnipeg, Canada*
Utica Gas & Electric Co.	Utica, N. Y.*

*Under construction.

To this list should be added the following companies which buy a large percentage of their gas from plants owned and operated by The Koppers Company:

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St. Paul Gas Company	St. Paul, Minn.
Peoples Gas Light & Coke Co.	Chicago, Ill.

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	Capacity Tons per day
*Dundee, Scotland (2nd Installation)	110
*Brechin, Scotland	21
*Newton-in-Makerfield, England (Extension)	18
*Dunfermline, Scotland	110
*Lochgelly, Scotland	21
*Ripon, England	40
*Walsall, England	100
*Kilsyth, Scotland	24
*Inverness, Scotland	40
*Bergen, Norway (2nd Installation)	57
*Stockport, England	168
*Glasgow, Scotland	1,356
*Adelaide, Australia	80
*Portsea Island, England (2nd Installation)	140
*Carnoustie, Scotland	21
*Wexford, Ireland	18
*London, G. L. & C. Co. (4th Installation)	200
*Neath, Wales Kensal Green	60
*Bolton, England (2nd Installation)	168
*Workington, England (Extension)	23
*Stourbridge, England	80
*Wolverhampton, England	80
*Troon, Scotland	28
*Trondhjem, Norway (2nd Installation)	38
*Warrington, England	112
*Manchester, England	336
Carried Forward	3,452

	Capacity Tons per day
Brought Forward	3,452
*Newton-in-Makerfield, England	21
*Wallasey, England (2nd Installation)	120
*Lanark, Scotland	21
*Gourock, Scotland	28
*Brighton, Australia	60
*Fremantle, Australia	20
*Christchurch, New Zealand	40
*Wanganui, New Zealand (2nd Installation)	40
Perth, Australia	60
*Birmingham (7th Installation) Nechells	840
*Sheffield, England	336
*Dairen, S. Manchuria	100
*Paisley, Scotland	140
Hinckley, England	60
Dresden, Germany (3rd Installation)	180
Cheltenham, England	120
Market Harborough, England	26
Leatherhead, England	40
The Hague, Holland	168
Liverpool, England	100
Paris, France	420
Geelong, Australia	60
Aberdeen, Scotland (2nd Installation)	192
Innerleithen, Scotland	7
Poole, England (4th Installation)	168
Buffalo, N. Y.	280
TOTAL CAPACITY Tons per day	7,166

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Gas Engineers and Builders of Gas Works

American Gas Journal

SIXTY FIFTH YEAR

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AMERICAN
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The Fuel of the Future--What Shall It Be?

VII. House heating with gas. The economic phase

Ismar Ginsberg, B. Sc., Chem. Eng.

IN THE six articles, which have been published on this subject in the American Gas Journal, the writer sought first to develop his argument that from certain industrial and technical standpoints gas was the logical fuel for use in every process or for every purpose for which heat is required. This is a rather broad statement, but it can be said without inviting criticism that there are but few—if any—heating problems that cannot be solved by gas and not only that but with a greater thermal efficiency than by any other fuel. There is, of course, ever persent the limitation set by economic and political conditions which in many localities prevent the use of gas for industrial purposes because of high rates and the obstacle of an artificially and legally set standard which does not permit the gas company to make the gas it is most suited to manufacture.

The Principles of Combustion

The writer has also tried to lay down the fundamental principles of combustion and heat utilization, defining the various terms employed by industrial gas engineers and technical men in general in dealing with heat problems and giving concrete examples of calculations which must be carried out by the sales engineer or the industrial gas man before he can determine the number of cubic feet of gas that will be required to perform a certain heating operation. The principles and the laws, which were described and discussed at some length in these preliminary articles, are now ready to be applied to practical heating operations, in which gas has, is or will supplant other fuels.

It is now our plan to treat the various heating problems both from the technical as well as the industrial and economic standpoints. Each problem has certain peculiar characteristics of its own, not only of a technical nature, but of other character as well. Then, again, there are certain fundamental considerations which apply to all industrial heating problems, such as the rate at which gas is sold for use in industry. That this rate must be a competitive one is hardly necessary to state. Gas cannot compete with oil, coke or electricity unless it is sold on a basis which gives it a chance to meet the competition that is found in the heating field at the present time and that will most likely increase as gas becomes a real contender in the industrial battle. There are serious limitations placed upon the development of gas as an industrial fuel by the rates which are today prevalent in most states of the Union. It must be emphasized that not only the high industrial rates themselves are deterrents to gas progress, but the structure of the rates prevents the gas company from entering the industrial field, as completely as it might desire.

Gas as an Iudustrial Business

This brings us to the consideration of gas as an industrial business. As a pure public utility its business was assured from year to year. Whether times were bad or not, gas was bought by the consumer and used in the household for cooking, baking, water heating and perhaps house heating on a small scale. The commissions and courts have taken into consideration the non-competitive nature of the business—that is, its apparent certainty of varying around an average at all times—in their determination of the just rate of return that the gas companies should be allowed to receive on their capital investment and the amount of business done. This return was low, much lower than what is made in other businesses, and purposely so, to compensate for the protection that the gas business enjoyed in being assured of this return, no matter what general business conditions throughout the country happened to be.

Gas Business Becoming Industrial

Now the gas business is assuming an increasingly

industrial aspect. It is undertaking to serve with a fuel industry as well as the household. But industry is governed by different forces than the household If a factory cannot sell its product, it does not manufacture, and if it does not manufacture, it does not require fuel, either gas or any other combustible. In other words, the general business conditions of the country will affect the gas business under these circumstnces, for it stands to reason that the gas company cannot hope to sell gas to factories that are not operating for want of a market for their goods.

Diversity in Industrial Business

It may be held that the gas company can protect itself by acquiring a diversity of industrial business, so that if one branch of enterprise is experiencing bad times, the loss of business in that direction may be made up by an increased business in another industrial field. But this is possible in only the largest cities and is in itself not the most satisfactory way in which the gas company should and must protect itself againts periodic declines in industrial gas sales brought about by business depression. The smaller cities, particularly those which form what may be called industrial centers for certain manufactured products, or in which the predominating manufacturing industry is limited to one or two products, such as Akron, the rubber center of the country, or Detroit, the automobile center, will be seriously affected by a slump in the automobile or rubber business.

Disability of a Limited Return

If the gas company has a large plant ready to serve these consumers with their fuel, and if they do not use the fuel because of business depression, the company will sustain a direct loss which it cannot and must not bear. If the rate of return remains the same for industrial business as well as for domestic business, it is evident that the gas company will never be able to make up its loss. This is what is holding back many a gas company from assuming industrial business and if it were unsurmountable it would be a very serious obstacle to industrial gas progress.

But it is not. Recourse is, of course, possible to Public Service Commissions for permission to accrue a larger return, but this would be a rather difficult matter to bring to a successful conclusion. There is a far better, more satisfactory and, we may say, much easier method and that is to apply to the Commission for a reconstruction of the rate system along the lines which have been so successful in Kansas and other sections of the country.

The Demand Charge

The above diversion may seem to be a bit out of place, but the question of house heating is closely tied up with the entire industrial gas problem and the economic and political phases of house heating, which is the principal subject of this article, are primarily based on the gas rate. Neither industrial business in general nor house heating by gas in particular can become universal unless the rate structure is scientifically made. It is not a question of getting the most out of the consumer or of the customer getting the most out of the gas company. It is simply a question of justice, fair play, asking the consumer to pay for the service he receives, just like he pays the grocery man for his groceries or the butcher for the meat he buys and the service given in having his purchases delivered to him.

Business Wants to Pay for the Service It Receives

The same condition applies to the factory. Business wants to pay for what it receives in service. It expects to do so, and then why should it not pay the gas company for the service that it is giving, especially when so many real economies and improvements in manufacturing processes as well as in the manufactured products are brought about by the use of gas. It is only fair that the consumers, both industrial and domestic, should pay for the service that they expect to receive at any moment that they turn on the gas through a fixed charge each month, dependent on the amount of gas that they contract to use as a maximum at any given time. The customer is simply asked how much of its manufacturing equipment should be set aside to supply his maximum want. The gas company expects him to use this maximum quantity of gas per unit time at any and every time. It maintains its equipment to meet this demand and it asks the customer to compensate it for being ever ready to satisfy the same. This fixed charge made each month, directly dependent on the quantity of gas demanded, must be paid, irrespective of whether the gas is used or not. It is based on the interest on the equipment. This is the demand charge.

The Demand Charge and House Heating Business

The average gas company has hesitated very much in selling gas for house heating, because the load is so seasonal. All the business is conceatrated within three to four months and, not only that, but at any time during the winter, when the weather is severe, the company may be called upon to deliver such large volumes of gas that the holder may go down altogether and nobody can get any gas. This would, of course, be a serious condition, and, furthermore, it is a very serious matter for the gas company to have to maintain a large plant to supply the maximum gas demand which may occur only on anywhere from a dozen days to a few weeks during the entire year. It is nearly always a very difficult matter to find other business at other times of the year when the equipment stands idle for the equipment which is required to make this maximum gas consumption. The expense involved in maintaining the plant under these conditions is very great. If the gas company were required to operate permanently under such conditions, it is hard to see how there could be any really universal house heating business. But the application of the demand charge in states where the three-

part rate structure is legal has produced remarkable results, not the least being the laying-to-rest of the bug-a-bear, the variable house heating load.

How the Demand Charge Operates

The application of a demand charge has the effect of a bridle on a spirited horse. The consumer contracts for a certain hourly, limiting supply of gas, and his limited demand meter is set to allow this maximum volume of gas flow through per hour. He cannot draw any more gas than this maximum and if he should require more gas he must arrange for a new contract and the matter must be regulated for the greater demand. The consumer is charged at a fixed rate each month for his demand of gas, whether he uses the same or not. The gas company is thus reimbursed for its investment in plant and equipment, whether this equipment is used or not.

It must maintain the same to supply the maximum demand for gas whenever that occurs. It has therefore no worry about the load, for that is taken care of in the demand charge, and all it must do is to see that the plant is kept ready to meet the maximum load when it develops. Everybody that wants to use gas for house heating can contract with the gas company for his required supply of gas, and the latter prepares itself to deliver the gas by making whatever increases in its plant equipment are necessary. The investment is paid for by the consumer, as it must be and as it is under all industrial conditions. The only difference is that the gas company knows what maximum load to expect and can arrange its plant to manufacture the maximum gas supply required.

Demand Charge and the Consumer

The consumer benefits, for the demand charge, being part of the three-part rate, distributes the fixed expenses among all the consumers instead of making the average 40 per cent of the gas company's customers, who are carried at a profit, cover the losses incurred on the remaining 60 per cent. Those who use the most gas, unde this system, pay for it at the least rate per 1,000 cubic feet.

Gas Demand Tends to Be Limited

The limited demand system has another beneficial effect. When the consumer is asked how much gas he requires for his house heating, water heating, cooking, etc., he generally does not know how to figure the hourly demand. But he is told what this must be to keep his house warm on moderately cold days. If he insists on having the house warm on the coldest days of the year or else if he wants every room of the house used under such conditions, he is told that his hourly demand will be greater and that he will have to pay for it accordingly, not only during the month that he uses the maximum supply of gas, but during every other month of the year as well. For, his increased demand of gas means that the gas company must set aside a larger proportion of its plant and equipment for his use at a time when he calls for his maximum supply of gas, allotted to him. What generally happens under these circumstances is that the consumer is convinced that he can do with a lower hourly demand of gas and the gas company is relieved of the burden of providing additional facilities to take care of him and others like him.

Consumption Is Increased Instead of Decreased

The natural consequence of such a system would seem to be a reduced consumption of gas per consumer. But, strange as it may appear, this is not so. In fact, actual observations over prolonged periods of time in cities, where the demand meters were installed, have shown that the average consumption of gas per consumer under all sorts of conditions was greater after the demand meter was installed than before. This may seem paradoxical, but it is absolutely true.

The tabulation given below contains results which substantiate this statement. Just what the reason for this increased consumption is may be hard to find. It may be purely psychological in that the consumer, contracting and paying for a certain hourly demand, endeavors to use more gas. It may be that the fact that the more gas he would use the less he would pay for each cubic foot was the incentive for using more gas. The house heating business certainly increased under these conditions, for the company no longer hesitated going after all of this business that it could obtain. It was fully protected and earned a fair return on all its business and the customers were satisfied, for they soon saw that they were greatly benefited under the new system.

The Variation in Demand Before and After Installation of Demand Meters

	Before Demand Meters were installed. Dec. 24, '20	After Meters installed. Feb. 29, '22
1. Peak hour	9-10 A. M.	9-10 A. M.
2. Atmospheric temperature during peak hour	14° F.	13° F.
3. Peak hour town border delivery (%)	100.0	77.1
4. No. of customers (%)	100.0	101.0
5. Peak hour delivery per customer (cu. ft.)	65.2	49.8
6. Peak day town border delivery (%)	100.0	119.0
7. Peak day delivery per customer (cu. ft.)	820.0	970.0
8. Peak day load factor* (%)	52.3	81.1
9. Peak mo. load factor* (%)	43.3	66.5

*The average hourly load divided by the maximum hourly load during the period specified.

Other Economic Features of House Heating Business

It is clear that the essential characteristic of the

house heating business is the establishment of an equitable, scientific rate that will enable the gas companies to go out after the business without worrying about the load that it will have to meet when it is obtained. But there are other conditions that govern the sale of gas for this purpose.

There is no doubt but that gas is still more expensive than coal for use in heating a house. The average ton of anthracite coal can be displaced with 15 million B. T. U. of heat delivered in the furnace. To give the same amount of heat about 25,000 cubic feet of gas, possessing an average heating value of 600 B. T. U., will be required. If the ton of coal costs $15, then it is evident that gas will have to cost 60 cents per thousand cubic feet in order that the total cost remain the same in both cases. It is, of course, impossible to secure gas with such a high heating value at that price under present conditions.

Gas Must Be Sold in Spite of Its Price

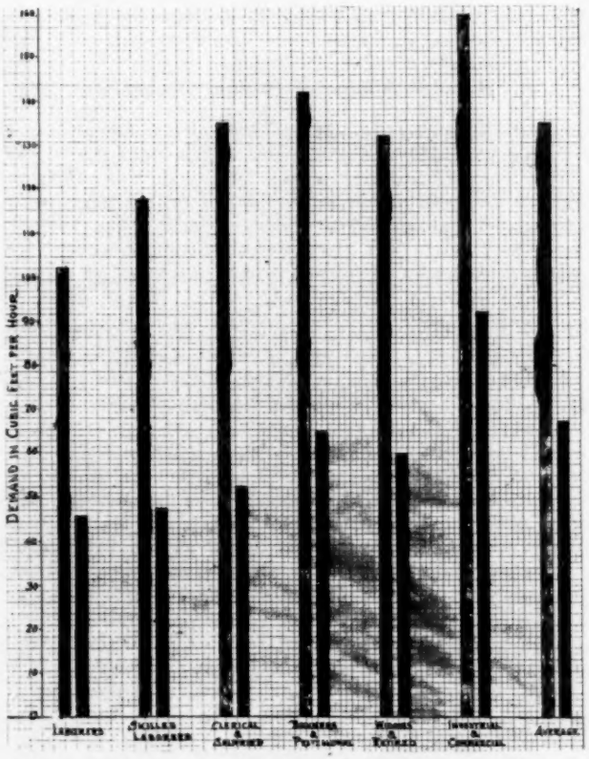
The gas salesman must make up his mind that gas is the more expensive fuel and sell it in spite of the price. The whole matter depends on the income of the customer. If he is a poor man, he cannot afford to pay the higher price for gas, for he will gain nothing to offset this higher cost. On the other hand, if he is a man of moderate means, it will pay him to use gas instead of coal for many reasons. He probably hires a furnace man to take care of his furnace and to remove his ashes. He can very likely use to good advantage the space released when gas is employed as the house heating fuel, due to doing away with the coal bin. The more uniform temperature obtained with gas and the greater cleanliness of the house, when coal is not used for house heating, will all appeal to him. The gas salesman must approach him along these lines.

Gas is being sold for house heating in many cities, even where there is a straight rate, by using these sales arguments, and as long as the price of gas remains higher than that of coal on the heat value basis, it will have to be sold in this way.

Curves Indicating Practical Operating Results

A number of curves are included with this article, which show the practical results that were obtained by the application of a limiting demand rate system in certain cities. These curves are very important, for they present undeniable, incontrovertible proof of the practicality and the mutual advantages to be gained both by the public and the gas company by the establishment of such a rate structure.

The first curve shows the changes in the demand that took place after the installation of limiting demand meters in comparison with the hourly demand for gas under the old system. The vertical solid oblongs indicate the demand for each class of customers, the taller oblongs showing the hourly demand before the installation of the limited demand meters and the shorter oblongs that after the installation of the meters. In every case the demand after the installation was less than before. The apparent reasons for this have been discussed above. Thus in the case of the laboring class of customers the demand before installation was 102.5 cubic feet per hour,



Curve Sheet No. 1—Changes in Gas Demand (Tall Oblongs, Demand Before Installation of Limiting Demand Meters; Short Oblongs, After Installation

while that after installation was 45 cubic feet per hour. It is interesting to note that the greatest decrease in the demand per hour was in the business and professional class of customers, while the least was in the industrial and commercial class. The average hourly demand before the installation of limited demand meters was 134.5 cubic feet, while that after installation was only 67 cubic feet, a decrease of approximately 50 per cent.

Effect of Demand Meter on Load Factor

The second curve shows the effect of the demand meter on the load factor. The horizontal line indicates the maximum hourly demand of the customers who contracted for gas on the new rate basis. It is interesting to see that the maximum supply of gas actually demanded of the gas company never reached the indicated demand, and was far less than the maximum demand before the installation of the meters. The demand curve after installation of the limited demand meters was much more regular than that before installation. The curves are drawn from results which were obtained during two winters.

(Continued on Page 42)

INDUSTRIAL GAS LESSONS

IF IT'S DONE WITH HEAT — YOU CAN DO IT BETTER WITH GAS

LESSON No. 2

How heat is produced and the changes effected by it

There are really a great many ways in which a body can acquire heat. Probably the most natural way is to come in contact with a hotter body. It is well known that heat will travel from a colder to a hotter body; in fact, this may be called the fundamental, axiomatic property of heat, and the infallible means of detecting its presence in a body when it is not already seen from the color of the same that it is hot. Thus, when we see a piece of iron colored red and know that this is not a mere coating of paint over the surface of the same, it is conclusive evidence that that piece of iron contains considerable heat.

But there are many other ways that a body can gain heat besides coming in contact with a hotter body. Thus, the passage of the electric current through some substances, known as conductors, will serve to heat them; then, again, mere rubbing together of two substances will produce heat, the heat of friction. When a liquid is churned, it will heat up. Then, again, when certain substances are merely mixed together, heat will be generated, as, for example, when strong sulphuric acid is dissolved in water.

Classification of Heat Producing Processes

All these processes of producing heat in a substance may, however, be classed under two divisions:

1. Generating heat in a body by contact with a hotter one.
2. Generating heat in a body by the transformation of other forms of energy into heat energy.

While all these different forms of generating heat are of interest to the engineer, for the fact that heat is produced in these ways has a marked effect on the way in which machines operate—thus the generation of heat through friction in a bearing is important because of its effect on the metal—the gas engineer is concerned more particularly with the development of heat through the transformation of chemical energy. That is the production of heat by the burning of coal or gas wherein the original substances are converted into new kinds of matter and heat is evolved during this transformation. This subject will be dealt with more in detail in later lessons.

Changes Effected by Heat

Just as important as the ways in which heat is generated are the changes that are effected by heat. What heat can do is an important matter from various standpoints, and the gas engineer, who deals primarily with a means of creating heat, must be well-versed in the effects that can be produced with it and the various laws which govern the degree and the character of these effects, before he can hope to apply his particular fuel, gas, to induce these effects with a greater degree of efficiency than by the use of other means and methods of producing heat.

For our purpose it is expedient to divide the changes brought about by heat into three great classes, namely, physical, chemical and physiological. The physiological effects, while perhaps the most important from a personal standpoint, are similarly the least important from an industrial or technical standpoint. It is well known that heat is essential to life. All human beings and animals are able to withstand a certain degree of excessive heat or of excessive lack of heat. Great cold and great heat are both injurious to the body and will destroy it.

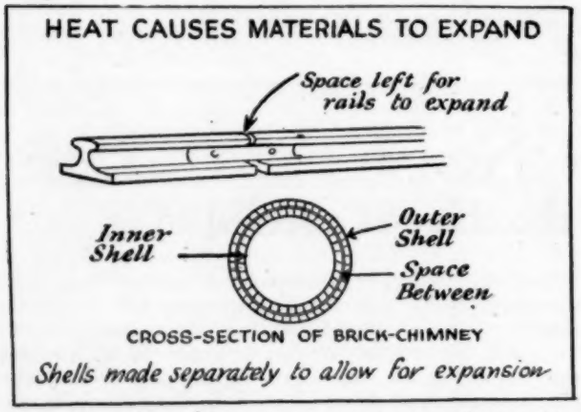
The Physical Effects

The physical effects of heat are many. It will be well to explain the more important of these in brief at this point, leaving their more detailed discussion for other lessons. Perhaps the most evident effect of heat is to raise the temperature of a substance. Strictly speaking, there are exceptions to this rule, but these are merely apparent exceptions, as will be shown later. Thus, it is well known that if water is brought to a boil in a kettle and a thermometer is stuck into the water, it will register 212 degrees F. But this temperature will not rise, although the gas is kept burning with a strong flame under the kettle. Heat is being absorbed by the water and still the temperature does not rise. Where does the heat go? It is consumed in changing the water from the liquid condition to the vapor condition, steam.

The Expansion of Substances

Another important physical effect of heat, which is not so evident as temperature change, is the expansion of substances. It is generally true that, when heat is applied to a solid, it will expand, that is, it will occupy greater space as the temperature is raised. Thus it is known that railroad tracks are

longer in summer than in winter. This phenomenon is taken care of in joining the different sections of the track together by leaving a clearance space at the joint. Similarly the side of a building which is



exposed to the sun's rays is conceivably higher than the shady side.

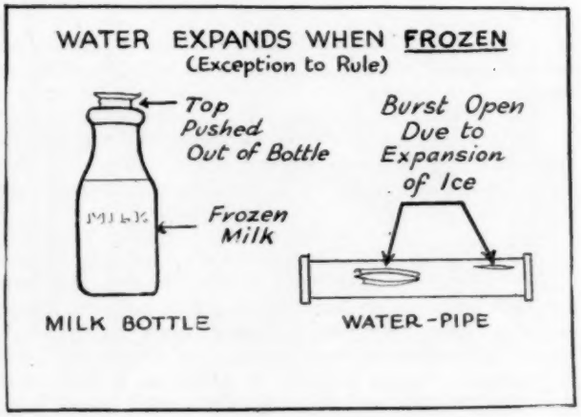
Thus a brick chimney will expand with heat, the inner side in direct contact with the hot chimney gases expanding more than the outer side which is in contact with the colder atmosphere. Hence the inner and outer shells are constructed free of one another, so that the inner shell may expand under the influence of heat without cracking the outer shell. The fact that heat will expand solids must be remembered in making bearings. If the bearing is made too tight and due to lack of proper lubrication, which is possible at any time, the shaft expands because of the generation of heat through friction of the metal of the shaft against the metal of the bearing, it may happen that the bearing will grip the shaft so tightly that the latter will be twisted off or badly scored.

The Peculiar Case of Ice

But it is not absolutely true that all substances expand with heat. Some, strangely enough, will contract. The best example is ice. When the temperature of ice is raised, it melts and the resulting liquid occupies a lesser volume than the original ice. This may be better explained by reversing the order of the process. While the addition of heat to a substance causes it to expand, obviously the subtraction of heat contracts it. Thus, when water is cooled, it naturally contracts, but when it reaches a certain temperature, just before the freezing point is attained, it commences to expand. Hence the volume of ice formed is always greater than the volume of the original water. This is the reason why a bottle, filled to the cork with water and tightly stoppered, will burst when the water is frozen. It is the reason why water pipes burst when they freeze. It explains the peculiar condition of a frozen bottle of milk—for milk consists mostly of water—with a solid mass of the frozen liquid pushed out of the neck of the bottle, indicating clearly that the volume of the frozen solid milk is considerably greater than the volume of the liquid milk in the bottle.

Solids Under Stress

When solid is subjected to alternate heat and cold and is held fast in such a fashion that it cannot freely expand and contract, or else has to undergo simultaneous expansion and contraction, it is apt to be subjected to strain which may result in its rupture. This, for example, may take place in a long steam pipe held fast at two points. Thus, if it is fixed while hot, it will contract on cooling, and, being restrained, it will break. On the other hand, if it is fixed when cold, it will be subjected to strain when it becomes hot. Then, again, the cylinder of a gas engine, which is cooled by a water jacket, will have to endure both expansion and contraction at one and the same time, a condition which must be taken care of in the design of the engine in order to avoid rupture of the cylinder.



CORK USED ON FLOORS BAKED IN BIG GAS OVEN

A gas-fired oven 120 feet long through which heavy iron moulds containing ground cork travel at the rate of 45 minutes for the trip, is a recent application of manufactured gas to industrial uses.

The cork tiles, used as a floor-covering in banks and office buildings, are made by grinding the cork and moulding it under a pressure of 5,000 pounds to the square inch. When the material has been pressed into the mould, it must be baked at a temperature that will cause the natural resin to flow and to act as a binder.

A temperature of 600 degrees exactly must be maintained through the length of the oven, since any variation in heat produces a change in the color of the finished product. Ten pyrometers, set along the side of the oven, indicate the temperature of the different parts, so that the gas burners can be regulated for each ten feet of length.

In addition to the baking tiles, seven tons of iron, the weight of the pressure moulds, pass through the oven in an hour, and this metal must be heated to and held at 600 degrees throughout the process.

Cork tiles of three shades are manufactured, the color changes being made by temperature variations.

As The Journal Views It

HOUSE HEATING WITH GAS

The article in the "Fuel of the Future" series, which is published in the present issue of the American Gas Journal, is concerned with the economic phase of the house heating business. There is much to say on the technical side of this subject, but the economic aspect is perhaps the more important of the two.

It is an unrefuted fact that house heating with gas is a field where much development can take place. There has been but little progress in this direction in recent years, but it now appears that the gas industry is giving, or commencing to give, serious attention to this matter. It is becoming cognizant of the undeveloped possibilities of the house heating business, and furthermore it is being brought to the attention of gas men that other fuels are making considerable progress in supplanting coal as a house heating fuel.

It must be apparent to all that the logical fuel for house heating is gas. At least, from the technical standpoint, it offers greater advantages than any of the other fuels. It can be utilized at greater thermal efficiency; it is more easy to convert existing installations into gas burning heating systems. Gas is cleaner and easier to control. One stumbling block stands in the way of its universal application, and that is the gas rate, or, rather, the manner in which the rate structure is built up. What the solution of this problem is may be debatable. It is certain that whatever method is suggested, certain objections will be found to it. Local conditions vary too greatly for a general cure-all plan to be developed and applied with equally satisfactory results everywhere.

Some gas men hold that the business is undesirable. It certainly is, under certain conditions. But it is conceivable that the rate structure can be changed so that the house heating business may become just as advantageous to the gas company as the water heating business.

While not advanced as an unalloyed solution of the problem, the three-part rate appears to offer more encouragement than any of the proposed plans under which this house-heating business can be corralled. With modifications, as demanded by local conditions, it may be the "open Sesame" of the entire difficulty.

One effect it does have, and that is, it relieves the gas company of the burden of maintaining a large plant, idle for many months of the year, to take care of this business during the short winter season in which it exists. It puts the burden of this maintenance where it belongs, on the customer. It makes it profitable for the customer to use gas in quantities. It makes him define his demand and asks him to pay for the fraction of the manufacturing equipment that is maintained by the gas company at all times to supply the maximum amount of gas that he requires for his purpose. It removes the condition where a large majority of gas customers are carried at a loss, and where this loss must be borne by the minority who use gas in profitable quantities.

The long and short of this problem is simply this: House heating business may be acquired by the gas company when conditions are right. A certain proportion of it may and is being obtained in spite of conditions. Prosperous people are willing to pay the price for gas that is asked, even though it is much higher than what they would have to pay for other fuels. They pay the highest price, just as they select the more expensive suit of clothes or the Oriental rug for their homes in place of the less expensive domestic carpet.

The business is there to be gotten. Other fuels, particularly oil, are entering the field and making, it is reported, considerable progress. The field logically belongs to gas. Gas can dominate it. But before gas can become universally used as a house heating fuel, the economic disability must be removed in some way. The most promise seems to be afforded by the three-part rate.

A Set of Safety Rules for By-Product Plants*

25—The preventing of accidents is one of your most important duties.

26—Make it your duty to see that all dangerous places are well lighted at all times. Many places which are safe in daylight or safe for men familiar with them may be extremely dangerous to new men when it is dark.

27—Before crossing tracks: Stop, look and listen.

28—House cleaning conditions must be watched carefully. All departments should be kept clean and free from all accumulation of waste materials. Clean up after each job.

RULES FOR COKE OVENS

1—There is danger in passing under moving machinery, from falling objects, or broken parts of machines.

2—Before moving pusher, charging cars, or quenching cars and locomotives, be sure no one is in a position to be injured.

3—Attention is called to the danger of coming in contact with electric power wires or rails supplying power to pusher, charging cars and electric locomotives.

4—Do not open or shut any gas, steam, liquid or other valves or electric switches, unless it is your duty to do so.

5—See that all shafting and gears are properly guarded at all times, and that all handrails are in place and safe. Report all dangerous places to your foreman at once.

6—Never throw objects of any nature from the top of the ovens or platforms without first making sure that no one is in a position to be injured.

7—In oiling or working around machinery, do not wear loose or ragged clothing; be sure your sleeves are tight at the wrist.

8—When closing, opening or cleaning charging holes and stand pipes, work on the side from which the wind is blowing. When gas or smoke is escaping from an oven, remember it may ignite at any moment, and may cause painful burns.

9—Never stand in front of the oven doors when they are being raised or lowered. If necessary to steady them do so with a shovel and stand to one side so that, if cable or hook breaks, the door will not fall on you. Door hoisters must inspect cables and hooks each shift before starting work and report any signs of failure or weakness to foreman at once.

* Continued from last week as part of the paper presented by F. J. O'Malley, at the Twelfth Annual Convention of the National Safety Council.

Work Outlined for A. G. A. Sections

At the December meeting of the Carbonization and Complete Gasification of Coal Committee of Technical Section of the American Gas Association, it was decided to adopt the following program for the Operators' Section:

1a—To study the effect of inerts on the cost of coal gas manufacture in all types of plants under practical operating conditions, but not taking into consideration dilution by producer gas.

1b—A similar study taking into consideration dilution with producer gas.

2—To make a study of the operating data returns secured from coal gas companies by last year's committee to see what missionary work can be done with companies whose returns indicate that they did not have adequate equipment for securing the best and comparable results. These returns will be classified by the committee with regard to size of plants so that recommendations as to equipment can be made with a view to the economic limitations of the smaller plants.

3—The small standard form of coal carbonization data sheet will be again sent out this year, but the distribution will be limited to those companies whose 1923 returns indicated that their results were secured on a comparable basis.

4—The preparation of a larger form of complete gasification test code giving total heat balance, etc., for all types of plants designed particularly to afford comparisons of larger coal gas companies.

5—Study and report on all labor-saving devices used in the manufacture of coal gas.

6—To follow up Professor Demorest's experiments on the relative value of sized versus run-of-mine and slack coal by arranging for actual works tests in a number of situations, including horizontals, verticals, continuous verticals and coke ovens.

This committee has also appointed various members to the work of gathering the latest possible information concerning low temperature carbonization, by-product coke ovens and steaming verticals.

Meeting of Customers Accounting Committee

At a meeting of the Customers Accounting Committee of the Accounting Section, which was held in the Commodore Hotel, Mr. H. J. Johnson of the Remington Typewriter Company described the system of bookless bookkeeping as prepared by his company. It is planned to compile a list of all members of the association using such a system and to check up the results obtained from this method. Several members of the committee have been asked to prepare papers on the subject, which will be read at the next meeting to the committee.

A study of the use and advantage of a budget system (as outlined last year) from the engineers' viewpoint will be made by the committee of the Accounting Section having this important item in hand. The committee will also make a study of the practical operation of a budget in the gas company and the viewpoints of the officials of the company.

Catechism of Central Station Gas Engineering in the United States

Installment No. 2

(Continued from Last Week)

Average analyses of some of the coals mentioned above follow:

	Volatile Matter	Fixed Carbon	Ash	Sulphur
Pittsburg	35-40%	54-58%	3-5%	0.6%
West Virginia	35-40%	53-57%	4-7%	1.0%
Kanawha	34-40%	55-62%	2-4%	0.6-1.5%
Breckenridge Cannel	47%	42%	10%	0.6%
Tennessee Gas Coal	36-39%	56-60%	1.8-3%	0.8%
Jellico Cannel	50%	35%	14%	0.7%
Alabama—Corona Seam	34-41%	50-59%	7-9%	0.7%
Kansas—Cherokee	37%	52%	9%	2.5-8%
Oklahoma	37-40%	51-55%	4-7%	0.9-1.3%
Washington—Roslyn	28%	61%	9%	0.1%
Colorado—Trinidad	3-37%	51-57%	9%	0.7-1.4%
Cape Breton	35%	53%	5.5%	3%

Definition of Run of Mine Coal and Best Class of Coal for Carbonizing.

13. Give the meaning of the terms "run of mine," "¾-inch" and "1½-inch" as applied to bituminous coal, and state, with your reasons for the statement, which class of coal gives the best carbonizing results.

Ans. "Run of mine" coal is coal which is shipped from the mine in the condition in which it is mined and loaded into the mine cars, being run from these cars directly into the railroad cars, or the boats, as the case may be, without being screened. It consists therefore of a mixture of lumps of all sizes with slack or dust.

"¾-inch" coal is coal that has been passed over a ¾-inch screen before being loaded into the railroad car, or the boat, and has therefore been freed from the slack and dust as well as from the smaller pieces of coal that pass through the screen.

"1½-inch" coal is coal that has been passed over a 1½-inch screen, and is therefore still more free from small pieces than is ¾-inch coal.

The screens used at the tipples of the coal mine are, as a rule, not made with meshes, but aer formed by parallel bars of iron running the long way of the screen. In a ¾-inch screen the bars have a clear space ¾-inch wide between them, and in a 1½-inch screen the clear space is 1½ inches wide. The openings in the screens are long narrow slits, through which will pass not only the small cubes but also long pieces of small cross-section.

Better Results With Screened Coal

The screened coal gives better carbonizing results than the "run of mine," since the latter is not only harder to burn off, owing to the dust contained in it, which forms in the retort a compact mass through which the heat can only penetrate slowly and with difficulty, but also contains more dirt and slate and a larger percentage of sulphur and will not yield as much gas per pound, or as clean gas, even when carefully and thoroughly carbonized. The majority of companies manufacturing coal gas buy ¾-inch coal, it being thought that as long as the slack is screened out there is no practical difference in value between the small lumps and the larger ones. However, at least one large company uses 1½-inch coal, and the engineer of this company considers that the results obtained from it are enough better than those obtained from ¾-inch coal to more than compensate for the higher price charged for it.

Why Lump Coal Is Best

14. What, if any, are the reasons for preferring lump coal to slack, or "run of the mine," for use in coal gas retorts?

Ans. Lump coal, when exposed to heat in a retort, yields its gas more readily than does slack coal or "run of the mine," "run of the mine" being a mixture of slack and lump. It loses gas less rapidly when stored. Lump coal also contains ordinarily a smaller percentage of ash than does slack, is more readily dried, and absorbs moisture more slowly. The net result is that lump coal stores better, and yields more gas and better coke, with a smaller consumption of fuel under the retorts, than does slack, or "run of the mine."

Deterioration of Gas Coals

15. Is there any reason why gas coal that has been put into the coal shed of a gas works should not be left there indefinitely, if the supply is maintained so that it is not necessary to use it?

Ans. For any given gas works the answer to this question depends upon the character and qualities of the coal used.

Some gas coals break up very badly when stored, the lumps becoming gradually converted into slack, and as this breaking up exposes fresh surfaces, as well as a greater surface in proportion to the volume, to the action of the air, and thus makes it easier for slow oxidation of the coal to take place, a comparatively rapid deterioration sets in and may continue

until the value of the coal is practically destroyed. Under these conditions it is not advisable to keep coal in stock for any length of time, and a practice should be made of working out the oldest stock at regular and short intervals.

However, many of the gas coals used in this country, particularly those from Western Pennsylvania, do not depreciate to any great extent when stored, except on the surface of the pile, and even in this portion the loss is very small after the end of the first six months, so that such coal when stored in fairly deep piles, protected from the weather, will suffer only a small total depreciation, the larger part of which takes place in the first year, even when stored for many years. When using coal of this kind, any stock that it is not necessary to use can be left in store indefinitely as far as loss in gas making value is concerned, since after having been stored for a year, the future depreciation on it will be much less than would be suffered by fresh coal stored in its place, and it is better to use the fresh coal, even if it is not possible to also make a saving in cost of handling by working the fresh coal directly into the retort house instead of having to put it into and take it out of the shed.

But even when the coal does not depreciate sufficiently to call for working out old stock, it is advisable to do this every few years and clean out the shed, for the purpose of checking the accuracy of the coal account as carried on the books, since in most coal sheds it is impossible to secure an accurate check in any other way. If, however, the coal is stored in pockets, into one of which a known quantity has been put and allowed to remain undisturbed, or if the stock pile is kept entirely separate from the rest of the coal and not drawn upon, there will be no reason for not keeping indefinitely a stock of coal of the character spoken of in the preceding paragraph, except an emergency when no other coal can be obtained.

Reason for Spontaneous Combustion of Soft Coal

16. What is thought to be the cause of spontaneous combustion in bituminous coal? Is this combustion more apt to occur in dry coal or in wet coal, in small coal or in large coal?

Ans. Investigations into the causes of the spontaneous ignition and combustion of bituminous coal have been made chiefly with reference to the occurrence of such combustion on board of coal laden vessels, but there is no reason why the conclusions reached in the case of coal stored on board vessels should not apply to coal stored in sheds. The theory that is now generally accepted as a result of the careful investigations of several Commissions is that the occurrence of any spontaneous increase in the temperature of coal is due chiefly to the condensation and absorption by the coal of oxygen from the air, which causes heating and thus promotes the chemical combination of the oxygen with the volatile hydrocarbons in the coal and even with some of the carbon itself. The conditions favoring the occurrence of this action to an extent sufficient to generate enough heat to effect the ignition of the coal are "a moderately high external temperature; a broken condition of the coal, affording fresh surfaces for absorbing oxygen; a supply of air sufficient for the purpose but not in the nature of a strong current adequate to remove the heat; a considerable percentage of volatile combustible matter or an extremely divided condition." The action of moisture upon the sulphur present in the form of iron pyrites is a secondary cause of heating, principally because of its effect in breaking up the coal and presenting fresh surfaces for the absorption of oxygen.

Since the smaller the pieces the greater the proportion between the surface exposed to air and the mass of coal, small coal affords much greater opportunity for the occurrence of the reaction between oxygen and coal which causes spontaneous combustion, and therefore such combustion is more apt to occur with small coal than with large coal. In coals that contain much iron pyrites the presence of moisture increases the liability to spontaneous combustion because, as has been previously stated, the moisture and pyrites act together to break up the coal and thus expose a larger extent of fresh surface to the action of oxygen. When iron pyrites are absent, or present to only a small extent, the presence of moisture retards the absorption of oxygen and therefore reduces the danger of spontaneous combustion, and in fact this danger can be entirely done away with by keeping the coal thoroughly soaked with water.

Dangers to Be Avoided in Storing Soft Coal

17. What danger is to be guarded against in storing bituminous coal? Is this danger greater with dry coal or with wet coal? With fine coal or with large coal? What precautions should be taken to guard against it?

Ans. Spontaneous combustion is a danger that should be guarded against in storing bituminous coal. This danger is greater with wet coal than with dry, with fine than with large coal. To guard against it care should be taken in storing bituminous coal in a coal shed that no excessive breakage occurs during the handling of the coal into the shed; that it is dry and large when received and is handled only in dry weather; that it is well protected from the weather when in the shed, and that it is not exposed to external heating as would be the case if it were stored in close proximity to a boiler or bench of retorts or over steam pipes. The floor of the shed should be dry, and made of incombustible materials, and all roof or track supports passing through and imbedded in the coal should be made of iron or brick. If the storage of wet or fine coal cannot be avoided, no large amount of such coal should be piled together, in any one place, but it should be, as far as possible, distributed in a thin layer over the faces and top of the pile and allowed to become thoroughly dry before being covered with any other coal. It is best not to attempt any ventilation of the pile, since insufficient ventilation is much more dangerous than none at all, and from the nature of the case it is practically impossible to obtain sufficient ventilation.

It is also well not to store coal recently mined, at least a month being allowed to elapse after mining before the coal is stored.

Prevention of Spontaneous Combustion

The taking of these precautions will tend to prevent the occurrence of any spontaneous increase in the temperature of the coal, since this increase is probably due chiefly to the condensation and absorption by the coal of oxygen from the air, which causes heating and thus promotes the chemical combination of the oxygen with the volatile hydrocarbons in the coal, and even with some of the carbon itself. The conditions favoring the occurrence of this action to an extent sufficient to generate enough heat to effect the ignition of coal are "a moderately high external temperature; a broken condition of the coal, affording fresh surfaces for absorbing oxygen; a supply of air sufficient for the purpose, but not in the nature of a strong current adequate to remove the heat; a considerable percentage of volatile combustible matter or an extremely divided condition." The action of moisture upon the sulphur present in the form of iron pyrites is a secondary cause of heating principally because of its effect in beaking up the coal and presenting fresh surfaces for the absorption of oxygen.

Early Detection of Heating of Coal Pile

To detect the existence of any heating before it has reached a dangerous point, 1 in. pipes should be either set up on the floor of the shed so as to be imbedded in the coal as the shed is filled, or else should be driven through the coal after the shed is filled. These pipes should be closed at the bottom, should reach from the floor of the shed to a point just above the top of the coal and should be spaced not more than ten feet apart, from centre to centre, throughout the whole space filled with coal. In each pipe should be placed a wire stretched by the weight of a small iron rod suspended from it and just long enough to allow the point of the rod to touch the bottom of the pipe. By keeping one hand closed around the wire and slowly drawing it up until the rod is reached, the existence of any abnormal temperature can be detected and the place where it occurs located. The exact temperatures existing at any hot point can be determined by lowering thermometers down the pipes in which the wires are found to be heated. Under normal conditions, where there is no reason to anticipate trouble, the inspection of the condition of the wires need not be made oftener than once a week, but when any heating has been found, no matter how slight it is, or there is reason to believe that it may occur, observations should be made at least once a day. If the temperature becomes high at any point and continues to rise, steps should be taken at once to prevent any ignition of the coal. The safest method is to work into the pile at the hot point and expose the coal that is heating to the air by spreading it out in a thin layer. As long as the coal has not begun to burn this will stop the heating. If the coal has fired, the fire must be uncovered and then extinguished. It is of very little use to try to put out the fire without digging down to the coal that is burning.

Part 2—Anthracite Coal

Selection of Anthracite for Water Gas Making

18. What condition, other than the size, would determine your choice in selecting one of several kinds of anthracite coal offered for use as the generator fuel in a carburetted water gas apparatus?

Ans. The object sought in selecting an anthracite coal for use as the generator fuel in a carburetted water gas apparatus is to obtain the coal that will produce the most gas at the smallest cost. The price being equal, the cost of the gas is affected by the quantity of gas that can be made from a given weight of fuel, the amount of sulphur compounds in the gas, the rate at which the gas can be made and the amount of labor required to handle the apparatus. The quantity of gas that can be made depends largely upon the amount of fixed carbon in the coal and also upon the hardness and ability to withstand handling, and the weight of the fuel above it in the generator, without breaking up into small pieces. The amount of sulphur compounds in the gas depends, of course, upon the amount of sulphur in the coal, other things being equal. The rate at which gas can be made is influenced by the ability of the coal to resist crushing, without which the fire cannot be kept in good condition for gas making, as well as by the amount and character of the ash through its influence upon the nature and quantity of the clinker formed. This latter also determines the amount of labor required for cleaning the fire, while the cost of labor for gas making proper depends upon the rate at which the gas is made.

Importance of Fixed Carbon Percentage

The best coal for the purpose named is therefore the one that contains the largest percentage of fixed carbon and is hard enough not to break up into small pieces in the generator, or while being handled before being put into the generator, and shows only small percentages of sulphur and of an ash that produces a clinker that does not unduly obstruct the passage of the blast and steam through the fire, nor make the cleaning of the fire difficult. To fulfill this condition the ash should not contain much sulphur or iron. Since a red color is due to the presence of iron, the white ash coals give the least trouble from clinker.

It is, however, difficult to secure a coal that possesses all of the above qualities in the highest degree, and also entirely possible to pay too much for them. Therefore, in making a choice between different kinds of coal it is always necessary to balance advantages in one direction against disadvantages in another and so determine carefully the relative values of the different samples, selecting the one that is shown in this way to be the cheapest at this price.

Advantages and Disadvantages of Various Water Gas Fuels

19. What are the respective advantages and disadvantages of anthracite coal, gas coke, and furnace coke when considered with reference to their use as the fuel in the generator of a carburetted water gas apparatus?

Ans. Anthracite coal will contain less ash than gas coke and will therefore make less clinker than such coke. Since it is much denser than coke a given generator volume will hold a greater weight of fuel when coal is used and this fuel will neither heat up nor lose its heat as rapidly as coke. This permits of longer "runs" and "blows" and so reduces the percentage borne by the time required for opening and closing the valves in putting on and taking off the runs, to the total time during which the machine is in operation. With coal there is also the further advantage that the generator does not have to be opened as often for charging as is necessary with coke.

On the other hand, the surface presented to the action of the blast and steam is smaller with anthracite coal than it is with gas coke, owing to the porous nature of the latter. The irregular form and roughness of the individual pieces of coke keep the fuel bed in a condition favorable for the general and intimate contact of both blast and steam with the carbon of the fuel. The heat can therefore be gotten up quickly and gas made at a rapid rate during the shorter run, and with quick workmen the increase of time required for handling the valves owing to the shortness of the blows and runs is not of great importance. It is, however, necessary when using gas coke to be very careful not to unduly prolong either the blows or the runs, since, owing to the rapidity with which coke is consumed, any over blowing increases the fuel account very greatly, while any extra length of run increases the amount of carbon dioxide in the gas very rapidly, because the fire cools off quickly.

Better Results With Coal

In general it is probably true that fair results as to the quantity of fuel used per 1,000 cubic feet of gas and the quality of gas made can be secured more easily with coal than with gas coke, but that, given good management and the necessary supervision to ensure the proper handling of each kind of fuel, there is little, if any, choice between the two materials.

Furnace or oven coke, unless it is made from carefully washed coal, or from coal that is originally free from ash, such as that used in making Connellsville coke, is apt to contain more ash than gas coke and to give trouble from clinker. It does not possess the density of anthracite coal nor is it as porous as gas coke. The 48-hour or soft coke makes a better generator fuel than does the 72-hour or hard coke. Opinions differ as to the relative merits of furnace coke and gas coke, some engineers preferring gas coke and others furnace coke under similar conditions.

Given the proper handling of each, there is, however, little difference between the three classes of fuel, and even slight differences in prices or in local conditions will be sufficient to turn the scale in favor of one or the other.

Best Size of Hard Coal for Water Gas Making

20. What size of anthracite coal and what size of coke is best suited for use as the fuel in the generator of a carburetted water gas apparatus? Give the reasons for your answer.

Ans. The sizes of anthracite coal that are usually considered available for use as the fuel in the generator of a carburetted water gas apparatus are:

Steamboat, consisting of pieces which pass through a screen in which the bars are set from 4 in. to 7 in. apart, the smaller sizes of coal having previously been screened out;

Broken, consisting of pieces which fall through a screen with a 4 in. mesh, but pass over one with a 2½ to 2¾ in. mesh, and

Egg, consisting of the pieces which fall through a screen of 2¼ in. to 2¾ in. mesh, but pass over one with a 1½ in. to 1⅞ in. mesh.

Of these sizes, that known as broken has been found to give the best results for general use, though in very large generators, those over eight feet in diameter, the steamboat size might be better.

Advantages of Broken Coal

The advantages possessed by broken coal are, that the lumps are sufficiently large to maintain the bulk of the fire in an open state, which affords a ready passage to the air in blasting and the steam when making gas, and yet are small enough to present a large surface of carbon to be acted upon by the oxygen, and it is thus possible to secure the proper combination of the greater portion of both oxygen and carbon in each case. Smaller coal affords a larger total surface, but at the same time forms a large compact mass in the center of the generator through which the air and steam cannot pass readily. They therefore pass only through that portion of the area of the generator which lies between the outside wall and this compact mass in the center. The larger size affords a freer fire, but much less total surface, and has moreover the disadvantage of being harder to handle.

In a paper on the "Selection of Anthracites for Water Gas," read before the American Gas Light Association, October 20th, 1892, Mr. C. R. Collins states that the inactive portion of the fire, which is due to the compacting of the coal in the center of the generator, where the lumps can fit into each other more perfectly than they can in the space next the walls, "varies with the diameter (of the generator) and with the size of the coal; thus in a particular generator egg coal renders about 30 per cent of the fire partially inactive, the bulk of the work being done in the outer parts representing 70 per cent of the fuel;

(Third Installment Next Week)

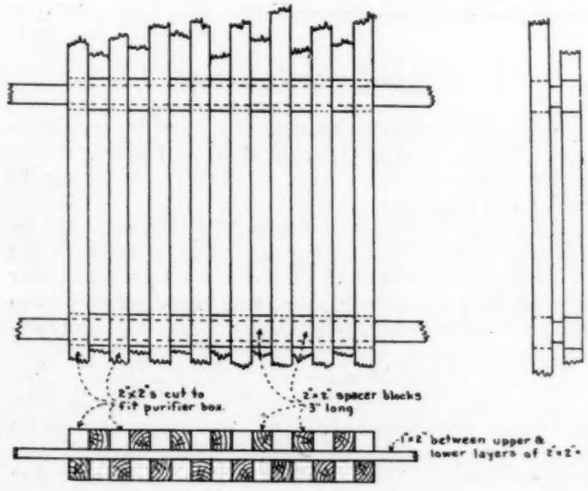
GAS WRINKLES

PURIFIER TRAYS

J. R. Moore, Los Angeles, Calif.

These purifier trays consist of a layer of 2 in. by 2 in. strips of wood spaced 2 in. apart, with a second layer of 2 in. by 2 in. strips above the first layer. The strips being so spaced that each strip in the upper layer will go over a space in the lower layer, the layers being separated by one inch strips 2 in. wide laid at right angles to the strips at considerable intervals.

The advantage of these trays over the old purifier grids is that they do not clog up so quickly and are much more easily cleaned. The relative area of tray to oxide remains the same as with ordinary grids.



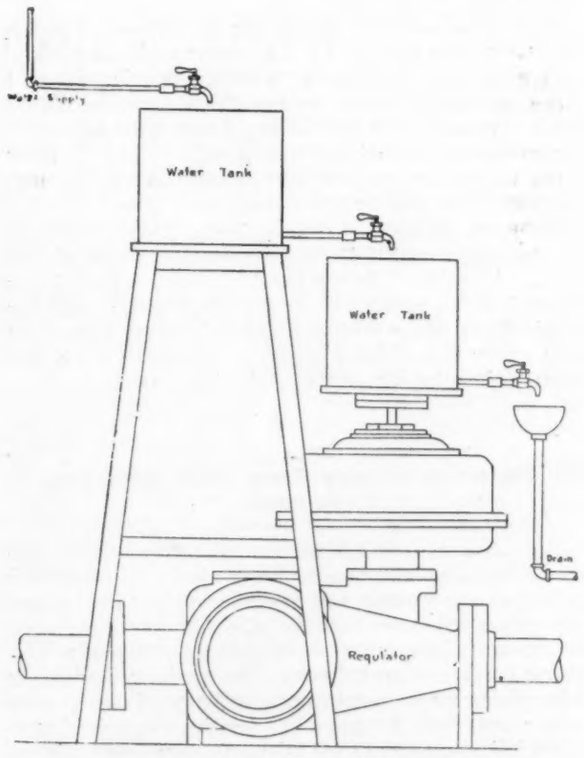
METHOD OF INCREASING AND DECREASING PRESSURE GRADUALLY BY MEANS OF STATION REGULATORS

F. E. Jinnett, Whittier, Calif.

This wrinkle was devised in order to save the time required in gradually raising or lowering the pressure on the outlet side of the regulator and likewise to gradually lower the pressure again as the peak load diminishes.

It is evident from a glance at the drawing that the required quantity of water is put in the upper water tank and at the time it is desired to gradually increase the pressure, the tap in this tank is opened very slightly so as to run a very small stream into the water tank connected with the diaphragm of the regultaor.

The operator need not wait for the second tank to fill, which may require an hour or more, likewise, after the peak load is over, the operator need only slightly open the outlet fom this tank and the water will gradually run off into the drain, thus gradually reducing the weight on the diaphragm and reducing in a corresponding degree of pressure on the outlet of the regulator.



The success with which the gradual increase and decrease of the pressure is obtained by this method is clearly shown on the accompanying chart.

GAS MERCHANDISING

Domestic – Industrial

A Few Rules for Success in Selling Gas Appliances

Frank H. Williams

The very successful manager of the appliance department of a western gas company gives the following as his rules for making a success in the selling of appliances:

Rule No. 1—Use as many gas appliances as possible in my own home. I can't expect to be successful in selling gas appliances to other people unless I think enough of them to use them myself. And I can't expect to talk convincingly and with authority to prospects about gas appliances unless I know from actual experience just what the various appliances I am selling will do.

Rule No. 2—Keep a thorough and accurate tab on all prospects and follow them up carefully all the time. A prospect in the hand is worth a half dozen possible sales in the offing. The first step in making a sale is to get a prospect and so I must remember that every time I let a prospect slip away I am just about doing the same thing as killing a sale.

All Visitors to Display Room Must Have Interest Aroused

Rule No. 3—Try to interest ALL the people who come into the salesroom. It is easier to interest a person in the appliances I am selling right at the spot where the appliances are for sale and where they can be successfully demonstrated than by means of advertising literature sent through the mail, or newspaper advertising or even telephone selling. Every person who comes into the gas office for the purpose of paying a bill or on any other mission connected with gas is a good prospect for me and should not be passed up.

Rule No. 4—Always make the salesroom just as attractive and as interesting as possible. I can never expect to sell an appliance to anyone if that appliance doesn't look clean or attractive or if I can't display the appliance in an interesting manner or talk about it in an interesting way. The very best possible way of selling appliances to all the many people who are constantly passing in and out of the salesroom is by this thing of always making everything in the salesroom just as interesting and attractive as possible.

Avoid Over-Insistence

Rule No. 5—Never be over-insistent in trying to make a sale. The very quickest way of killing a sale is by displaying too great eagerness in trying to make the prospect take it.

Rule No. 6—See to it that every purchaser of an appliance thoroughly understands the working of the appliance. To send out an appliance to a purchaser who doesn't know how to operate the appliance is to create trouble and dissatisfaction, and the dissatisfaction is sure to be communicated by the purchaser to friends and relatives—thus killing sales.

Rule No. 7—Stimulate sales among people who have but few appliances and also stimulate sales as much as possible among people who have numerous appliances. The more appliances a person has the easier it should be to sell additional appliances to that individual. No person, I must remember, is so thoroughly and completely equipped with gas appliances that there isn't room in the house or the store for a few more.

See as Many People as Possible Each Day

Rule No. 8—Push the sale of appliances with the utmost possible number of people every day. The more attempts there are made to sell appliances each day the more appliances there will be sold. Keeping everlastingly at it and interviewing as many people as possible a day and presenting our appliances to as many other people as possible each day is the best way of hanging up new sales records.

All of which is presented in the hope that it will offer worthwhile suggestions to other appliance department managers.

The Premium Idea in Selling Appliances

Harold F. Podhaski

Premiums!

Nothing new, perhaps, in that idea in the merchandising of gas stoves and equipment.

Premiums have helped many companies increase their sales for years—a set of dishes with a gas stove, a set of silverware, or something on that order.

Still there is always more or less interest in the premium idea of salesmnaship, where one can cite the results achieved. Or where the idea may perhaps be just a little bit different than the other fellow has been using.

In November the Georgia Railway & Power Co., of Atlanta, conducted a special campaign to boost the sale of gas ranges and heat regulators which this company handles in the Atlanta territory and with mighty good results, so far as increased sales are concerned. Many stoves were sold, in fact, that would still be setting on the floors of the show rooms save for this campaign.

A Box of Oranges Free

From November 19 to 29, inclusive, the company gave a box of fine Florida oranges free with every gas range purchased—a particularly good idea, as the Thanksgiving season was at hand, and equally o. k. for Christmas. Everyone eats oranges at Christmas time. At any rate, the method certainly did bring about a marked increase in the sale of these ranges during the period in question.

The plan was materially aided by a demonstration conducted during the campaign at the company's show rooms by an expert home economist, meals being served to visiting housewives daily at the company's down-town show roms, free, of course—naturally the meals having been cooked on the aforesaid range.

It is really surprising how many housewives accepted the company's invitation, contained in its regular newspaper advertising, and bought ranges during the progress of the sale. There was the added inducement, you know, of the free box of luscious oranges from the Florida groves.

Another good premium idea, especially for Thanksgiving or for Christmas, has been in progress in Charlotte, N. C., by the merchandising department of the Southern Public Utilities Co., in a campaign to increase the sale of the gas range which this firm handles in that territory.

The premium in this instance included a fat turkey, not less than ten pounds in weight, and free to every buyer of a gas range. At 50 cents per pound, which is the prevailing price in the Southeast, a ten-pound bird pays the cost of the initial payment on the installment purchase of a stove.

Properly used, the premium idea is as good a method as any for the increasing of gas range sales.

INTERNATIONAL GAS EXHIBIT IS PLANNED FOR 1924 IN PARIS

An international exhibition covering every phase of gas manufacture and use will be held in Paris during the summer of 1924 to celebrate the 100th birthday of the gas industry and the 50th anniversary of the Societe Technique de l'Industrie du Gaz, according to an announcement by the committee of organization.

Gas experts from all over the world will be invited to come to Paris for the exhibit, which, it is expected, will be held in the great hall of the Jardin d'Acclimation, and "which will make one corner of Paris a veritable city of gas," declares the committee.

Demonstrations of gas appliances, both for domestic and industrial use, will be held, and there will be meetings for the readings of papers and discussions dealing with the gas industry throughout the world.

The first manufactured gas plant in France was started in 1824 to light the streets of Paris. This was one year later than the first gas plant in New York State, from which has grown the present record consumption of 90,000,000,000 cubic feet a year here.

The first use of gas for industrial purposes came from Paris, when, in 1860, gas was used as fuel to melt zinc in cast iron crucibles. In spite of this early industrial use, gas is still chiefly used in France for lighting, and the streets of Paris are today illuminated very largely with the gas lamps of a century ago.

The gas industry in the United States, with a present investment of more than $4,000,000,000, has developed in the opposite direction. With the advent of the electric light less than two generations ago, the use of gas for lighting decreased, while its use for cooking and heating has grown rapidly. The present output of approximately 1,000,000,000 cubic feet a day cooks half of the country's food. Less than one-fifth of it is used for lighting; about half of the total is used for domestic cooking and heating, and the remainder is consumed as fuel in the industries.

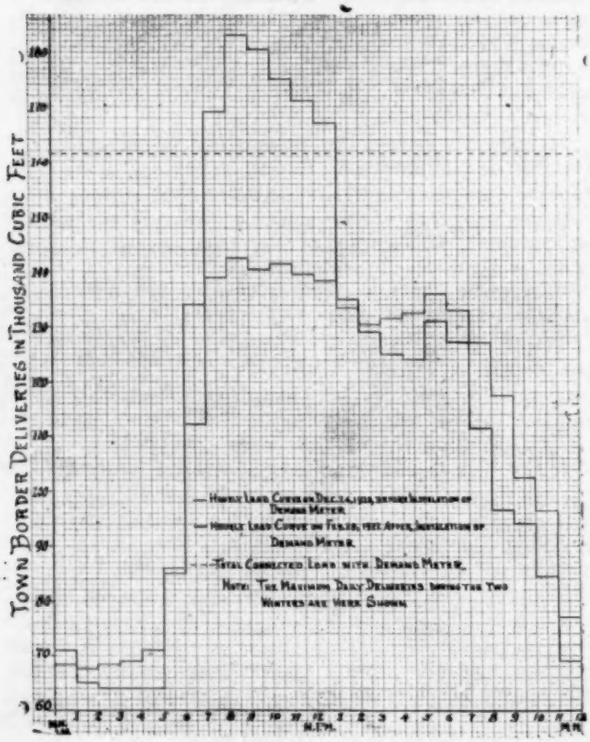
GAS OIL PRODUCTION

Gas and fuel oils produced in November amounted to 1,057,931,617 gallons, about 12,000,000 gallons less than in October. Imports decreased about 1,000,000 gallons and exports declined nearly 24,000,000 gallons. Sales for domestic consumption were 918,644,119 gallons, a decrease of approximately 97,000,000 gallons. Stock were 1,499,925,521 gallons on December 1, showing a gain during the month amounting to about 63,000,000 gallons.

(Continued from page 30.)

Limited Demand and Annual Sales per Customer

The third curve shows the relation between annual sales per customer before and after installation of the limited demand meters. It is evident that the sales per customer increased in each class of consumers, by far the greatest increase taking place in the industrial and commercial customers. As has been said, just what this increase was due to is a hard mat-



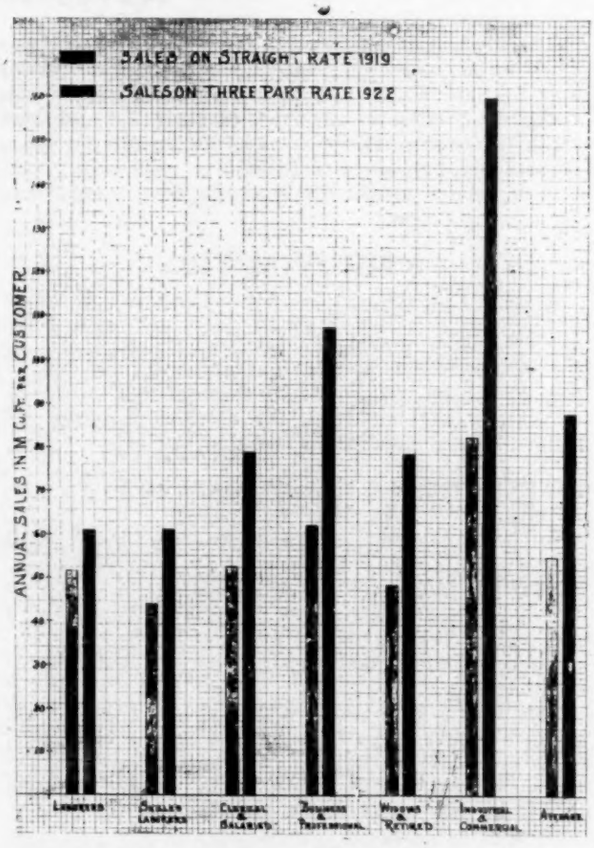
Curve Sheet No. 2—Load Factor

ter to tell, but the important point is that the installation of the limited demand charge, a part of the three-part rate, did not reduce the consumption of gas per customer, as some might have expected. The popularity of the new system is thus clearly demonstrated.

Limited Demand and Line Pressure

The fourth curve shows another important effect of the installation of limited demand meters on the pressure maintained throughout the distribution system. Under the old system, when a straight rate was charged for gas, at certain times during the year the demand for gas would be so great that the pressure on the line would have to be increased in order to get the gas to the consumer. Under the new system the distribution of the gas was more equalized, with the result that the pressure in the line was less and more uniform throughout the year.

These curves clearly showed how the limited demand meter benefited the gas company. It has just as great an advantage for the gas consumer. It is unquestionably fair to both. On the basis of this rate system any volume of house heating business and industrial business can be taken by the gas company without any danger of it losing out on it. In cases where the industrial user's demand is so high as to necessitate quite a high fixed charge per month, the question might arise as to the advisability of the former installing his own gas plant. This matter has been thoroughly threshed out a number of times and the only conclusion has been that it is far more economical for him in many ways to buy his gas from the gas company than to make it himself. After this has been proven to his satisfaction, it is easy to make him understand the equitable character of the demand charge.

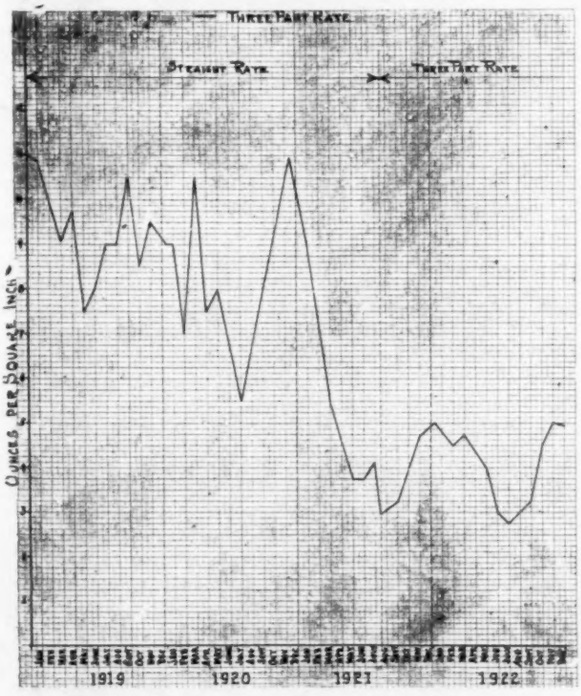


Curve Sheet No. 4—Annual Sales of Gas. (Tall Oblongs Indicate Gas Sales After Installation Limiting Demand Meters; Short Oblongs Before Installation.)

Getting a Man to Buy What He Can Afford, Not the Cheapest Article

There is an important underlying principle in the selling of gas for house heating which must be emphasized, for it is rather universally applied in the sale of many commodities and services. It is only

the very poorest among us that are constrained to buy only the very cheapest articles and even the poor like to buy what is better, if not best, without regard of the price. Thus the average man does not go in to buy the cheapest overcoat or suit of clothes, but he likes to purchase merchandise of better quality, finer tailoring, more up to date in style. It is that way with a great many things.



Curve Sheet No. 4—Pressure on Gas Mains

As far as house heating is concerned, only few people use the cheapest form of coal, soft coal. The dirt, smoke and bother of using that variety of coal are held to more than counterbalance the low price, and the average man or woman who has to buy coal for house heating is glad to pay a higher price and buy anthracite coal. Under the present conditions the price of anthracite is very high and may go higher. If it does there will be left but little of the price differential that separates gas from coal to the advantage of the latter. Still, in spite of the high price of anthracite coal, people are continuing to use it, for it possesses important advantages over soft coal.

Higher Price of Gas Should Be No Deterrent

The same reasoning holds good for gas. Gas is more expensive than hard coal for house heating and perhaps it will continue to be so for a long time. But that is no reason why gas should not be sold for house heating. The advantages of gas over hard coal and, in fact, over every other sort of fuel for house heating, are really too evident to require explanation or elaboration here. Everyone can see them and they are acknowledged by all. Thus gas is the best fuel that money can buy for house heating and its cost is relatively only a little more than the other fuels that have been used for this purpose. The man who wants to wear a fine suit of clothes, ride in a higher-priced car than a Ford, who appreciates the better service given by commodities that cost more than the cheapest on the market, is the man who will be glad to pay more for heating his house with gas in order to derive the benefits of this fuel.

Gas and Oil for House Heating

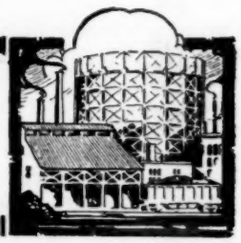
The gas man does not have to look far to obtain substantiation of that fundamental rule that the price of a commodity is not always what makes the sale. In certain localities and under certain conditions oil has supplanted anthracite coal as a house heating medium. The oil companies and others associated with them have been giving this part of the oil business considerable attention during the past few years, ever since the coal price commenced its upward rise. They have not hesitated to go after house heating business, even though they knew that oil was the more expensive fuel, and not only that, but that the house owner would have to go to a considerable expense in installing an entirely new equipment in which to store and use the oil. And, in spite of all the obstacles that were clearly visible in the path of progress, oil house heating business was strenuously drummed up, and there has undoubtedly been an increase in oil consumption for that purpose during the past two or three years.

The gas man has a much simpler problem. For the oil man must install submerged tanks, blowers and other special equipment before oil can be burned. Furthermore, the fire underwriters have very stringent regulations which must be followed to the letter before they will OK an oil burning installation. What the gas company has to do in the way of changing the present coal burning equipment in the house where gas is to be used will be discussed later in another article. It is sufficient to say that the difficulties are by no means as great as those that the oil man has to overcome.

Conclusion

The economic phase of the house heating business, therefore, centers around the limiting demand rate system. It is hard to see how the house heating business can develop in any really great proportions unless some restraint is placed on the demand for gas for this purpose by making the consumer pay a fixed charge per month to compensate the gas company for holding in readiness a part of its plant to serve him. The sale of gas for house heating must be based on the claim of better service that is given by gas and not on the price of this fuel in comparison with others. The prospective house heating customer must be made to see two points, one that gas will give him better service than any other fuel which will more than counterbalance the increased cost of using the gaseous fuel, and, second, that the only way in which the gas company can give him the service that he requires is by the establishment of a rate system in which there is a limiting demand charge, regulated by a limited demand meter.

NEWS OF THE GAS INDUSTRY



ATLANTIC CITY AGAIN SELECTED FOR A. G. A. MEETING.

1924 Meeting to Be Held During Month of October.

New York, N. Y.—The American Gas Association, the national organization of the manufactured gas industry, will hold its sixth annual convention some time during the month of October, 1924, at Atlantic City, N. J., it is announced at association headquarters.

This makes the third consecutive convention of this organization to be held at Atlantic City. Last year's sessions and exhibition of appliances were held on the Steel Pier, with special meetings extending to Traymore, Chalefonte and Haddon Hall. The official attendance records were 3,300, with 50,000 square feet of space used for exhibits, breaking all previous records for the annual gathering of this organization.

The 1924 meeting promises to exceed the previous year's attendance by at least 1,000, and several reservations for exhibitor's spaces have been made already at association headquarters here.

The special committee of the executive board which picked Atlantic City for the 1924 convention was composed of R. B. Brown of Milwaukee, chairman; George W. Parker of St. Louis, Charles A. Munroe of Chicago and H. C. Abell and William M. Crane of New York.

Consumers Gas Co. Making Appliances Right

Bartlesville, Okla.—The Consumers Gas Co., with headquarters in this city, has a gas service corps at work in the distributing centers where it sells gas, showing consumers how to get better returns for the money they spend for gas. The members of this corps are trained combustion engineers and appliance experts, and their efforts in the towns served by their company will save patrons a vast amount of money during the peak gas-burning season. These experts are visiting every home using gas and showing how to economize in the use of this fuel in order to get the best results. Lines and stoves are inspected and the appliances are properly regulated. The campaign includes a demonstration of high efficiency gas burning appliances at a central point in each locality.

To Spend $175,000 on Improvements

Lima, Ohio—Improvements aggregating $175,000 during 1924 are proposed by the Lima Natural Gas Co.'s financial budget.

Extension and replacement of mains will involve expenditures of $100,000 and $75,000 is petitioned for renewing of lines and services ahead of paving.

Program of expansion marked the activities of the company in the last 11 months of 1923, the most outstanding being the recent completion of an artificial manufacturing plant. This, the company believes, assures the city an ample gas supply, not only for the present, but sufficient to meet future demands if increased 50 per cent.

Expansion of the distribution system by 35,195 feet, or 6.6 miles, was made necessary in the last 11 months because of paving and sewer improvement by the city and also construction of new homes, which reached a record for recent years, the company's statement says.

Of the total footage of distribution extension, 8,526 feet of 10-inch line extended from Tanner avenue and Fourth street to the gas plant on S. Jackson street, at a cost of $20,000. This line serves as a conduit for the available gas supply direct to the million foot storage tank at the plant, thus enabling the company officials to determine the quantity of gas being furnished.

This transmission line has all welded joints, the first of its kind installed in the city. Welding equipment has been procured by the company and in the future all four-inch lines will be welded, officials announce.

The total distribution system in the city extends 12.92 miles, inclusive of the 6.6 miles placed this year. In addition to the improvement the company has installed 10,257 feet of service lines from main to curb, this bringing the total improvements to 50.26, giving a grand total of 179.18 miles of gas lines in the city.

The company owns and operates 77.97 miles of high tension transmission lines, which conduct the flow of gas from the wells to the city, making the total mileage of lines within and without the city reach 257.18 miles.

In addition to services rendered, the company installed 15,130 feet, or 2.86 miles of service line, on the consumers' premises from curb line to meter. At present the company has 95 applications on file for consumers' service.

Yearly Income Announced

San Francisco, Cal.—Net income of the Pacific Gas & Electric Co. during the year ended October 31 was $3,584,016, equal to $10.06 on each share of common stock, it was announced.

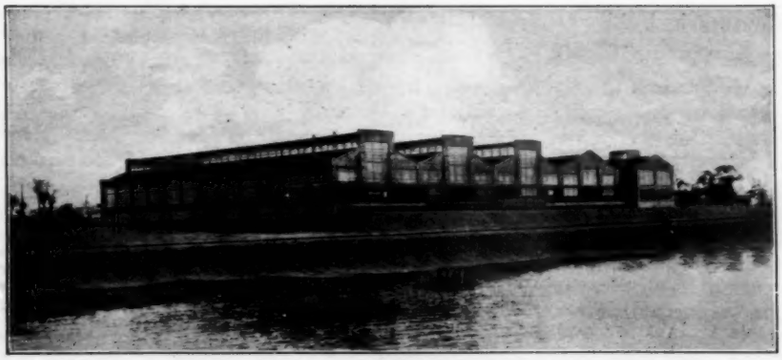
Ingram-Richardson New Enamel Plant at Bayonne, N. J.

Early in November the new plant of the Ingram-Richardson Mfg. Co., at Bayonne, N. J., was placed in production. This is the latest addition to the Ingram-Richardson chain of plants, where "Porceliron" enameled steel white parts are made for many lines of gas ranges, kitchen cabinets, tables and refrigerators. The original plant and home offices are at Beaver Falls, Pa. Other plants are located at Frankfort, Ind., and Pittsburgh, Pa.

The new Bayonne plant will specialize in enamel stove parts. It covers four and a half acres of ground and was built at a cost of more than $500,000. It is probably one of the best equipped porcelain enameling plants in the world. It is especially designed for the enameling of pressed steel kitchen furniture parts, table tops, and other porcelain enameled steel products. It is also equipped for the enameling of cast iron stove parts and other specialties.

The Ingram-Richardson Mfg. Co. is one of the pioneer porcelain enameling concerns in the United States. For more than a quarter century it has furnished porcelain equipment for well established lines of kitchen furniture.

The new plant was financed by the Ingram-Richardson Corporation and the Wm. M. Crane Co. of New York, organized under the laws of New Jersey with an authorized capital of $$750,000. The officers of the company are: Ernest Richardson, president, Beaver Falls, Pa.; G. H. Warner, vice-president, New York City; George Vaughan, treasurer, Jersey City, N. J.; and G. L. Harris, secretary. The last three named are also officers of the Wm. M. Crane Co., manufacturers of gas stoves and ranges. E. O. Kraft is general manager of the new plant and Francis Davidson is superintendent.



Ingram-Richardson New Enamel Plant at Bayonne, N. J.

A Potent Argument Against Municipal Ownership

New York, Jan. 12, 1923—According to Public Service Management, the venture in municipal ownership by New York City has been very expensive to the taxpayers. The journal reports as follows:

The demand of Mayor Hylan for the extension of municipal ownership in New York City cannot rest upon any records of efficiency and economy made by the city in those utilities it already owns and operates.

The Real Estate Board of New York has recently issued an interesting statement in which it says municipal operation of public utilities there always has been and always will be inefficient and uneconomical. It points out that in 1922 the municipal ferries alone lost $1,549,322.37 for the taxpayers to make up. The board adds:

"The position of the Real Estate Board of New York has always taken in regard to governmental operation of public utilities is that such operation is generally inefficient and uneconomical. This has been borne out time and again, but never more plainly than in the management of the New York City municipal ferries. In a statement issued several days since by Robert B. McIntyre, head of the Bureau of Statistics of the Controller's office, the deficit for 1922 is given as $1,549,322.37.

"Under private management these ferries were all self-sustaining as far as expense of operation was concerned and more than half of them paid a profit on the investment in them. It must be remembered that the expense of maintenance and operation in the city statement does not include depreciation or interest charges or taxes.

"Taxpayers and rent payers should consider this question of municipal operation carefully. There is a loss of $10,000,000 annually in subway operations which must be placed in the city budget. There is also the loss in the operation of trackless trolley lines, city buses and city operated trolley roads which must go in the budget.

"If the city spends $25,000,000 for municipally operated buses at a 5-cent fare the loss will total, based on experience of private corporations conducting similar businesses, at least $5,000,000 annually. This would mean a deficit of about $20,000,000 annually for municipal operation of public utilities, or a 20 per cent increase in the tax rates."

In the operation of the trackless trolley on Staten Island, New York's biggest experiment in the field of municipal operation of transit lines, the cost of carrying each passenger is 10.27 cents. This is the figure adduced by the Bureau of Statistics of the City of New York after a careful and complete investigation into the operation of the trackless trolley.

The fare charged by the city on this system is 5 cents. So each person who rides this line costs the taxpayers of New York City the difference between 5 cents and 10.27 cents, which is the amount the city pays to produce the service of one ride. This burden on the taxpayers for the benefit of the patrons of the trackless trolley line amounts to more than five and a quarter cents for each passenger each time he rides.

Public Service Co. of No. Ill. Purchases Chicago Heights Gas Co.

Blue Island, Ill.—The purchase by the Public Service Co. of Northern Illinois of the Chicago Heights Gas Co. has been approved in an order issued by the Illinois Commerce Commission and made public through the office of Britton I. Budd, president of the former company.

The order of the Commission, authorizing the purchase, provides that the Public Service Company shall connect the Chicago Heights gas plant with its great Blue Island plant within three years, but this will be done before that time, if possible, according to officials of the company. The mains for this connection will cost somewhere in the neighborhood of $300,000.

Important points in the order of the Illinois Commerce Commission, authorizing the purchase, are as follows:

1. Public Service Company agreed to purchase the entire capital stock of the Chicago Heights Gas Co. for $325,500.

2. That within three years the Public Service Company will lay 12½ miles of gas mains connecting the Chicago Heights gas plant with its Blue Island gas plant, giving to this city the additional facilities of that big plant. This improvement alone will cost several hundred thousand dollars.

3. That with the completion of the planned improvements, including the tie-in with the Blue Island plant, the company shall put into effect the lower standard rates of service then charged by the company in other cities where it provides service.

Awards Contract

The Interstate Public Service Co. has awarded contract to the U. G. I. Contracting Co. of Philadelphia to furnish and install the U. G. I. Vertical Retort Plant at Newcastle, Indiana. The plant will consist of two benches of standard U. G. I. vertical retorts, together with coal and coke handling equipment, condensing and scrubbing plant, exhausters, meters, purifiers, booster, yard connections and other work.

Upon the comlpetion of this work the ability of the Newcastle plant to furnish satisfactory service to its customers will be greatly enhanced.

Northern Indiana Gas Co. Presents Gifts to 2,000

South Bend, Ind.—Employees of the Northern Indiana Gas & Electric Co. will receive life insurance policies as Christmas gifts from the management of the company, according to an announcement made by G. M. Johnson, local manager.

The amount of the policies ranges from $500 up to $1,500, depending upon the length of service of employees. Employees will receive certificates of insurance under a group policy taken out by the company.

This insurance will continue in force for one year. The amount represented by each certificate is fixed by length of continuous service.

Samuel Insull of Chicago, president of the company, in a letter to each employee, which accompanied the insurance certificate, said:

"This gift of insurance is presented to you at this time in appreciation of your faithful service and in recognition of your loyal co-operation."

More than 2,000 employees of the company, assigned to various offices in Indiana, will receive the gift. It was announced that policies will be given to 203 persons in South Bend. Those employed by the company for six months or more are eligible.

Courses in Public Utility Work at Illinois

"The inauguration of courses in public utility work is justified by the importance of the public utility industry to the community," declared Dean R. E. Heilman, of the Northwestern University School of Commerce, at a meeting held to outline courses on public utility education to be given this fall at the University of Illinois.

"The schools of the country today teach banking, insurance, railroad work and many other special business subjects, but have neglected an industry which supplies light, communication, heat and transportation, and which is just as important to the welfare and prosperity of a community," said Dean Heilman.

"I am of the opinion that educational work of this character should be started in all of the great universities of the country, and most certainly in all the state universities. I believe that this program should start in the state universities because the state today is the political unit of government which controls and regulates utilities. Municipal regulation is a thing of the past in practically every state in the country."

Dean Charles M. Thompson, of the University of Illinois, laid stress on the vital importance of the public utilities and the need for education on the economic aspects of their relations with the public. He said:

"We have come to realize that we have neglected one of the big economic problems of the day. We have permitted an investment of approximately forty billion dollars to be made in the public utilities of the country, including the railroads, without giving attention to the important economic problem which that country represents. We should have taken up this work ten or fifteen years ago."

Correction

In our issue of January 5, it was stated that the Pennsylvania Engineering Works, Newcastle, Pa., had secured the services of Mr. C. E. Newdorfer from the Peter Conley Manufacturing Co. Mr. Newdorfer formerly was general superintendent of the Riter-Conley Co. of Pittsburgh, Pa.

Gas Manager Head of Commerce Bady

Hugo, Okla.—P. J. Hayes, manager of the Hugo office of the Oklahoma Power Co., was named president of the Hugo Chamber of Commerce at a meeting of the board of directors. Rush Record, banker, was named vice-president.